

Appl. No. 10/777,608

Attorney Docket No. 10808-119

I. Listing of Claims

1. (Previously Presented) A method for dry-cleaning metal residue from a semiconductor surface, comprising:

forming a metal trench pattern in a dielectric layer of a semiconductor device, the metal trench pattern having a conductive metal therein, the metal trench pattern having an edge to edge distance of 150 nm or less, the conductive metal and the dielectric layer defining a semiconductor surface;

preparing the semiconductor surface using a chemical mechanical polish (CMP) process, the metal residue including the conductive metal smeared in an unintended scratch at the semiconductor surface;

exposing the prepared semiconductor surface to a plasma and an inert gas, the plasma having ions reacting with the metal residue to form a volatile gas, the prepared semiconductor surface being exposed to the plasma for a predetermined range of time to directly remove the metal residue from the scratch; and

removing the metal residue in the unintended scratch at the semiconductor surface.

2. (Original) The method of claim 1 where the step of preparing the semiconductor surface forms the metal residue in the scratch.



BRINKS HOFER GILSON & LIONE
PO Box 10395
Chicago, IL 60611-5599

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3. (Original) The method of claim 1 where the metal trench pattern comprises a metal material selected from the group consisting of tungsten, copper, aluminum, and aluminum alloy.
4. (Previously Presented) The method of claim 3 where the metal residue comprises the metal material of the metal trench pattern as a consequence of the CMP process.
5. (Original) The method of claim 1 where the plasma comprises any one of CF₄, NF₃, CHF₃, C₄F₆, Br and Cl.
6. (Original) The method of claim 1 where the predetermined range of time of exposure to the plasma is based on the metal residue.
7. (Previously Presented) The method of claim 1 wherein the dielectric layer is a substrate material comprising any one of a silicon substrate, silicon on insulator substrate, silicon on sapphire substrate, glass substrate, ceramic substrate, gallium arsenide substrate and metallized substrate.
8. (Original) The method of claim 1 where the scratch has a depth of less than approximately 10% of a depth of the metal trench pattern.
9. (Original) The method of claim 1 where the metal residue in the scratch has a depth of approximately 5 nanometers.
10. (Previously Presented) A method of dry-cleaning a metal residue-filled scratch in a chemical mechanical polished semiconductor



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surface, the semiconductor surface defining a metal trench pattern having an edge to edge distance of 150 nm or less, the chemical mechanical polishing of the surface affecting the metal residue-filled scratch, the method comprising:

exposing the surface to a plasma, the plasma reacting with the residue to form a volatile gas, the plasma being diluted with an inert gas and having a pressure substantially in the range of 0.3 Torr, a gas flow rate of approximately 100 sccm and a temperature less than approximately 250 °C.

11. (Cancelled)

12. (Previously Presented) The method of claim 10 where the metal trench pattern comprises any one of tungsten, copper, aluminum and aluminum alloy.

13. (Original) The method of claim 12 where the plasma comprises any one of CF₄, NF₃, CHF₃, C₄F₈, Br and Cl.

14. (Original) The method of claim 13 where the surface is exposed to the plasma for approximately 10 seconds.

15. (Original) The method of claim 13 where the scratch has a depth of less than 10% of a depth of the metal pattern.

16. (Cancelled)

17. (Cancelled)

18. (Cancelled)



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19. (Cancelled)

20. (Cancelled)



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